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NOTES ON SOME KANSAS SALT MARSHES.

BY ROBERT HAY, JUNCTION CITY.

It is well known that in the ages before settlement, the wild animals of the plains — the deer, the bison, the antelope — had their places where they obtained salt These were known as *licks*, and, joined to the name of some animal, or to some epithet more or less descriptive, this word becomes a proper name. In these licks the saline matter was held in earths of various kinds — clays, and shales, and sandy alluvia; but not infrequently there were connected with them salt springs, from which hunters and early ranchmen obtained salt by evaporation.

Kansas has a fair proportion of these salt springs of the plains, and the National Government made over to the State sundry sections of land on which they were located, supposing that they were giving title to valuable mineral deposits. Some of these became part of the endowment of the State Normal College, at Emporia, but the prices for which they have been sold have not exceeded that of agricultural lands in the same regions.

Some of these licks, with or without springs, are *salt marshes* of considerable extent, at the lower end of which, streams that pass through them, or originate on them, are more or less saline in character. The Saline river has its name from this circumstance. There are salt marshes— .

1. In Cowley and Sumner counties, at and northwest of Geuda Springs.
2. In Stafford county, with a salt stream running into Reno county.
3. On Rattlesnake creek, in the north of Lincoln county.
4. On Salt creek, in Mitchell county.
5. On Plum creek, northeast of Beloit.
6. On Marsh creek, and Little Marsh creek, northwest and northeast of Jamestown,. in Cloud county.
7. On a small tributary of the Republican, in Republic county, northeast of Concordia.

Besides these, there are the salt pool of Meade county, salt springs in the Saline valley, and the salt plains of the Cimmaron, just outside the State. The first has been described by the present writer in an article published by the State Board of Agriculture.

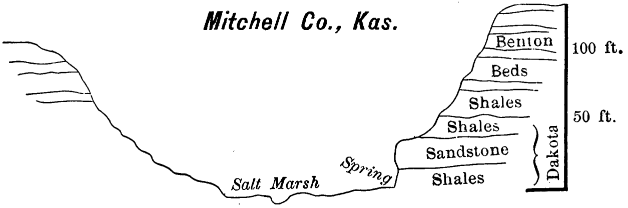
No. 7 in the above list of salt marshes is the Tuthill marsh described by Prof. Mudge, as State Geologist, a quarter of a century ago. As a barren salt marsh it is now much less in area than when our old friend was there, the alluvia from the plowed land of the district having washed over it, and allowed vegetation — typhaceæ, and other marsh plants — to obtain a firm hold.

The geology of the formations which furnish the salt to most of these areas has become plain to the writer through recent investigations. The salt marshes near Geuda Springs are related to shales which are at the top of the Permo-Carboniferous deposits of the region, or at the beginning of what I have elsewhere called the saliferous horizon, of which the great salt-rock deposits of Kingman, Reno and Ellsworth counties are the best-known exponents. Wellington is the place nearest to Geuda where the salt rock has been exploited. Near Geuda there is also a fine bed of saccharoidal gypsum. The position of the Cowley county salt marshes, in relation both to the gypsum and the rock salt, suggested that the salt marshes of Republic, Cloud, and Mitchell counties had some such relation to the gypsum of Marshall county and the rock salt of Ellsworth and Kanopolis. Visits to the regions indicated removed all ground for this idea, and revealed the true position of the marshes, showing that they all get their salt from shales of the Dakota period. The saccharoidal gypsum of Marshall county, outcropping on the banks of the Big and Little Blue, a few miles above Blue Rapids, is fully 250 feet lower in the geological scale than the gypsum near Geuda, and corresponds with an horizon of gypsiferous shales in the Permo-Carboniferous beds which are just below the lowest strata that outcrop in the railway cut at Fort Riley.

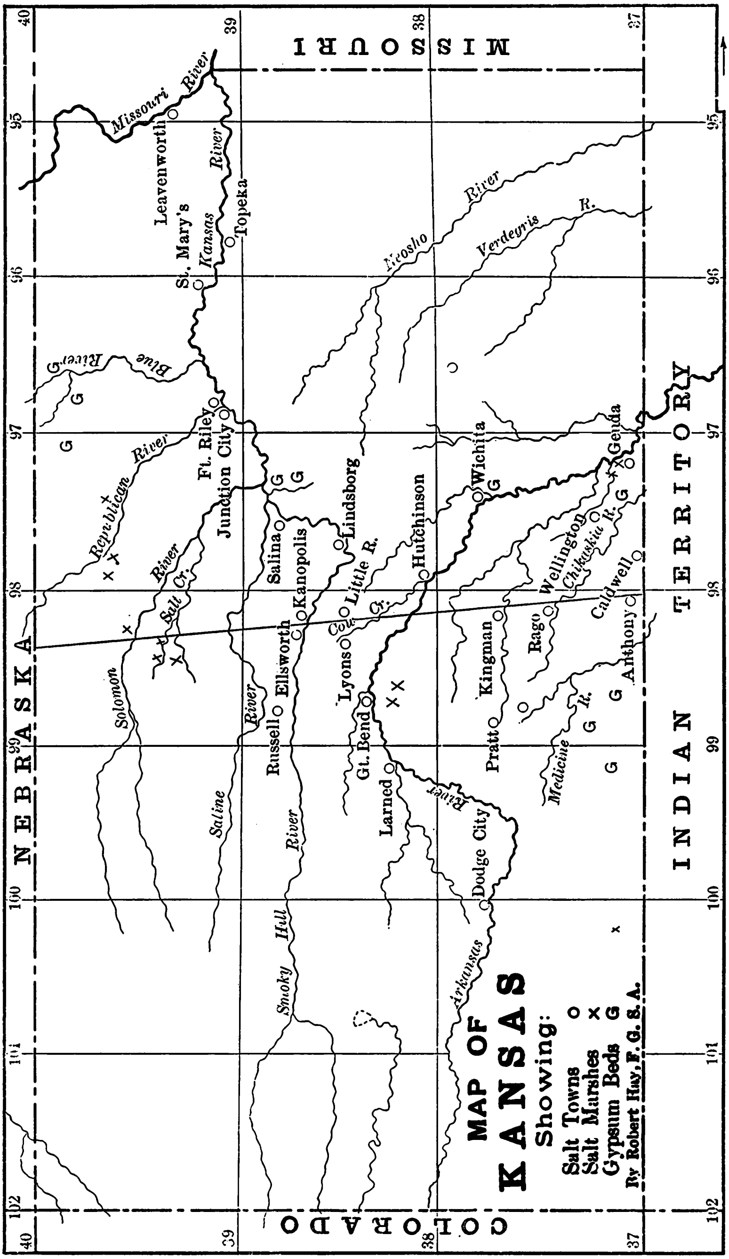
The largest of the northern salt marshes, and probably the largest in the State, is the one on Marsh creek (No. 6 in the list). Its lowest part is in section 4, town 5, range 5, W., and it has more than half of section 5, and stretches into three sections of town 4, and into some part of range 6. It is seven miles long, and in one place it is quite a mile across. Like the Tuthill marsh, its area has been reduced since the settlement of the region, and from the same cause, but its large areas of saline efflorescence, resembling snow-covered fields, are remarkable objects in the extensive views obtained from neighboring uplands. The marsh itself is below the level of the alluvial bottom. In places the alluvia form steep walls of 10 to 15 feet high, bounding the lower saline slopes, but elsewhere the alluvia have all been washed away, and the marsh slopes up to thin, sedimentary soils, formed of the shales and harder beds that constitute the geological bed-rock, and from which the marsh derives its salt. These shales are at the top of the Dakota formations, and wells sunk just outside the marsh, at higher levels, penetrate the highest Dakota sandstones, and these are seen in outcrop only a mile to the south. On the N.W. ¼ of section 5, town 5, range 5, some years ago, a well was bored fifty feet deep within the borders of the marsh. It gave an artesian flow of brine, which, though partially choked, is still running. Its strength on the salimeter was 14°, which is exactly the strength of brine taken from a hole six feet deep on the Tuthill marsh the day before. It was believed by the well-borers that a stream of fresh water diluted this flow of brine. The tops of the slopes, on all sides of the marsh, are crowned with the Benton limestones. Wells near by penetrate black shale, the analogue of the lignite bed of the upper Dakota, which, near Tuthill marsh and other places of the region, is worked for fuel. The bed of the marsh, in wet seasons, is a dangerous black bog. At the dry time of our visit it was safe, but soft to the foot.

There are two marshes on Salt creek, in Mitchell county (No. 4 of the list), differing little from the one just described, except that in both, the alluvia, forming vertical walls to the creek and marsh, are much thicker, being 15 to 20 feet in thickness; and in the larger marsh there are two vertical outcrops of Dakota sandstones, *in* one of which is a salt spring, and Benton shales are exposed at less than 25 feet above the highest exposure of Dakota formations.

FIG. IV. Section on a branch of Salt Creek, Mitchell Co., Kas.



In no essential particulars do any of the marshes (3 to 7 in the list, inclusive), eight in all, differ from the descriptions already given. The salt is in each case derived from shales of the Upper Dakota, so there is no connection with the salt-rock horizon which came at, or just after, the close of the Permo-Carboniferous period.


MAP OF
KANSAS
Showing:
Salt Towns ○
Salt Marshes ×
Gypsum Beds G
By Robert Hay, F. G. S. A.
NEBRASKA
MISSOURI
COLORADO
INDIAN TERRITORY
Missouri River
Kansas River
Blue River
Republican River
Solomon River
Salt Cr.
Saline River
Smoky Hill River
Arkansas River
Little R.
Cow Cr.
Neosho River
Verdegris R.
Chikaskia R.
Medicine R.
Leavenworth
St. Mary's
Topeka
Ft. Riley
Junction City
Salina
Kanopolis
Lindsborg
Ellsworth
Russell
Lyons
Gt. Bend
Larned
Dodge City
Hutchinson
Wichita
Kingman
Pratt
Rago
Wellington
Caldwell
Anthony
Geuda
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102

The writer has visited a salt marsh near Lincoln, Nebraska, which is also supplied from Dakota shales, which Prof. Hicks, the State Geologist, informs me belong to the middle of the series; and he also says that salt recently found by the drill at Hastings is at the bottom of the Dakota. It appears, then, that the Dakota must be added to the number of those rock series that are rightly termed saliferous. Perhaps the fact that the Dakota lignite and the Dakota dicotyledonous leaves indicate much land near marine deposits might have led us to infer shallow marine waters and possible salt deposits. The actual recognition of the salt shales justifies such inference, and is another fact in the physiography of the Dakota time. Possibly salt licks and salt marshes in other parts of the plains region may hereafter be recognized as belonging to the same Dakota horizon.

The plate and figure are from a longer article, on the "Geology of Kansas Salt," in the Seventh Biennial Report of the State Board of Agriculture.

ON THE STRUCTURE OF THE KANSAS CHALK.

BY S. W. WILLISTON.

In January, 1882, Mr. (now Dr.) W. S. Bunn, a student of Kansas University, published in the Lawrence (Kans.) *Home Journal*, a brief notice of organic remains occurring in the Kansas chalk. The means at his command did not enable him to clearly discern the objects, but his description renders it certain that he had detected coccoliths, though mistaken in his supposition as to their nature and origin.

That the chalk should be structureless, as had been previously believed by Professor Patrick, was hardly to be expected, and an examination confirms Dr. Bunn's statement of the organic origin of the material. That I did not give Dr. Bunn credit for first recognizing its organic nature, in a notice recently published by me in *Science*, is due to the fact that I have only become cognizant of his communication at the present writing.

The deposit seems wholly formed of coccoliths, rhabdoliths, and foraminifera, with, perhaps, radiolarians and sponges. The coccoliths exist as complete, or broken oval, or circular bodies from $\frac{1}{3500}$ to $\frac{1}{4500}$ of an inch in diameter, with from one to six depressions, or nuclei; the rhabdoliths as slender spicules, rarely attached to a central mass, or as rarely with a trumpet-shaped extremity. In addition there are other, less slender rods, from $\frac{1}{1000}$ to $\frac{1}{2000}$ of an inch in length, that *may* be radiolarian spicules. I have recognized at least a dozen forms of foraminifera, the one most common and conspicuous very similar to, if not identical with, a *Textilaria* of the English chalk.

A ready method of examining the material is to allow a thin film held in suspension in water to dry upon a slide, afterward mounting in balsam.

To obtain the heavier foraminifera, successive portions should be decanted from the vessel containing the powdered chalk disseminated in water, using the residue for examination.

In view of the foregoing facts, it seems to be time that the assertions of some of our leading text-books (*e. g.*, Winchell, Geological Studies, p. 433, and Leconte, Elements, p. 473) that there is no chalk in America, should be corrected.